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EXAMINER	
HALL, ASHA J	

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1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/801,987	**Applicant(s)** FUKAWA ET AL.	
	Examiner ASHA HALL	**Art Unit** 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5-12 and 23-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5-12 and 23-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *February 12, 2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on February 12, 2008 has been entered.

Claim Rejections - 35 USC 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 5, 6, 23-25, and 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US 6,479,744) in view of Wood et al. (US Patent 6,150,717).

As to claims 5 and 6, Tsuzuki et al. disclose a method for producing solar cell module in Figures 5A and 5B comprising: a step for providing (col.2; lines: 37-38) a plurality of solar cell elements (photovoltaic devices, 101 and 101’) having a front surface electrode/cover electrode (106) (col.10; lines: 43) formed on a light receiving surface (front side of the substrate) (col.1; lines: 49-51) of a semiconductor substrate (701) a shown in Figure 8. In Figure 8, a surface electrode/upper and collector

electrodes (706 and 707) is formed on a light-receiving surface of the semiconductor substrate (col.10, lines: 65-67) light is incident on the side of the cell bounded by upper and collector electrodes (706 and 707) and a back surface electrode/lower electrode (702) formed on a non-light receiving surface of the semiconductor substrate (701)(col.1; lines: 55-68). Tsuzuki et al. provides a step (col.2; lines: 37-38) for connection tabs/metal member (104) for interconnecting the surface electrode on the light-receiving surface and the back surface electrode on the non-light receiving surface of the solar cell elements as shown in Figures 5A and 5B (col.2; lines: 59-67 & col.3; lines: 1-2).

Tsuzuki et al. further disclose the step/process of connecting (col. 7, lines: 1-10) a first connection tabs to the front surface electrode of the one of the solar elements by way of a solder connection and then connecting a second connection tab to the back of the surface electron of another solar cell element by way of soldering (i.e, one layer for each of the two sides of the connection tab) (col. 3; lines: 14-15 & col.16; lines: 30-35) as shown in Figure 5B. Tsuzuki et al. further discloses a step for connecting the first connection tab to the second connection tab as shown in Figure 5B (col.3; lines: 34-37) and utilizes two different material types for electrodes (e.g. lower electrodes (702) are comprised of Al, Ag, Pt, Au, Ni, Ti, etc..) (col.11; lines: 36-39) and upper electrodes (706) are comprised of metal oxides such as SnO_2, ZnO, etc...(col.12; lines: 7-18).

However, Tsuzuki et al. fail to teach is that the second solder layer having different melting points than the first solder layer and that first solder has a higher

melting point than the second solder layer and that the first and second solder is melted and that it is disposed therebetween.

Wood et al. discloses a method for mounting electrical interconnections with solder (i.e. melting the solder) to the electrodes of the semiconductor device (col.1; lines: 15-24) and further discloses that one of the solder alloys can be a high temperature alloy and the other solder alloy a low temperature alloy and that it aids in the assembly of the semiconductor module (col.9; lines: 6-22). Wood teaches that when an electrode is of a lower melting temperature and the solder is of a higher melt temperature, then the solder can be reflowed to form bonded connections (col. 9; lines: 61-67). The solder temperature is chosen between the melt temperature of the electrode and solder melt temperature to allow for the solder to soften and not enter the liquid phase, such that it will have a structural rigidity (col. 9; lines: 61-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate two different solders with different melting points as taught by Wood et al. to the method of producing a solar cell module of Tsuzuki et al. in order to aid in the assembly of the semiconductor module with two different electrode materials that needs two different sold materials.

As to claims 23 and 24, Tsukuki et al. discloses method for producing a solar cell module according to claim 5 above, further comprising coating a surface of the electrode with the solder (col. 2; lines: 59-67 & col.3; lines: 1-2) layer before the step for connecting a first connection tab to the front surface electrode of one of the solar cell elements (col.3; lines: 11-15).

Tsuzuki et al. further disclose the step/process of connecting (col. 7, lines: 1-10) a first connection tabs to the front surface electrode of the one of the solar elements by way of a solder connection and then connecting a second connection tab to the back of the surface electron of another solar cell element by way of soldering (i.e, first connection tab is connected to the front of surface of the solar element and second connection tab is connected to the bottom surface of the other solar cell element wherein the first connection tab is not connected) (col. 3; lines: 14-15 & col.16; lines: 30-35) as shown in Figure 5B. Tsuzuki et al. further discloses a step for connecting the first connection tab to the second connection tab as shown in Figure 5B (col.3; lines: 34-37) and utilizes two different material types for electrodes (e.g. lower electrodes (702) are comprised of Al, Ag, Pt, Au, Ni, Ti, etc..) (col.11; lines: 36-39) and upper electrodes (706) are comprised of metal oxides such as SnO_2, ZnO, etc..(col.12; lines: 7-18).

However, Tsuzuki et al. fail to teach is that the second solder layer having different melting points than the first solder layer and that first solder has a higher melting point than the second solder layer and that the first and second solder is melted and that it is disposed therebetween.

Wood et al. discloses a method for mounting electrical interconnections with solder (i.e. melting the solder) to the electrodes of the semiconductor device (col.1; lines: 15-24) and further discloses that one of the solder alloys can be a high temperature alloy and the other solder alloy a low temperature alloy and that it aids in the assembly of the semiconductor module (col.9; lines: 6-22). Wood teaches that when an electrode is of a lower melting temperature and the solder is of a higher melt

temperature, then the solder can be reflowed to form bonded connections (col. 9; lines: 61-67). The solder temperature is chosen between the melt temperature of the electrode and solder melt temperature to allow for the solder to soften and not enter the liquid phase, such that it will have a structural rigidity (col. 9; lines: 61-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate two different solders with different melting points as taught by Wood et al. to the method of producing a solar cell module of Tsuzuki et al. in order in order to aid in the assembly of the semiconductor module with two different electrode materials that needs two different sold materials.

As to claims 25 and 32-33, Tsukuki et al. discloses method for producing a solar cell module, further comprising coating a surface of the electrode with the solder (col. 2; lines: 59-67 & col.3; lines: 1-2) layer before the step for connecting a first connection tab to the front surface electrode of one of the solar cell elements (col.3; lines: 11-15).

Tsuzuki et al. further disclose the step/process of connecting (col. 7, lines: 1-10) a first connection tabs to the front surface electrode of the one of the solar elements by way of a solder connection and then connecting a second connection tab to the back of the surface electron of another solar cell element by way of soldering (i.e, first connection tab is connected to the front of surface of the solar element and second connection tab is connected to the bottom surface of the other solar cell element wherein the first connection tab is not connected) (col. 3; lines: 14-15 & col.16; lines: 30-35) as shown in Figure 5B. Tsuzuki et al. further discloses a step for connecting the first connection tab to the second connection tab as shown in Figure 5B (col.3; lines: 34-37)

and utilizes two different material types for electrodes (e.g. lower electrodes (702) are comprised of Al, Ag, Pt, Au, Ni, Ti, etc..) (col.11; lines: 36-39) and upper electrodes (706) are comprised of metal oxides such as SnO_2, ZnO, etc..(col.12; lines: 7-18).

However, Tsuzuki et al. fail to teach is that the second solder layer having different melting points than the first solder layer and that first solder has a higher melting point than the second solder layer and that the first and second solder is melted and that it is disposed therebetween.

Wood et al. discloses a method for mounting electrical interconnections with solder (i.e. melting the solder) to the electrodes of the semiconductor device (col.1; lines: 15-24) and further discloses that one of the solder alloys can be a high temperature alloy and the other solder alloy a low temperature alloy and that it aids in the assembly of the semiconductor module (col.9; lines: 6-22). Wood teaches that when an electrode is of a lower melting temperature and the solder is of a higher melt temperature, then the solder can be reflowed to form bonded connections (col. 9; lines: 61-67). The solder temperature is chosen between the melt temperature of the electrode and solder melt temperature to allow for the solder to soften and not enter the liquid phase, such that it will have a structural rigidity (col. 9; lines: 61-67). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate two different solders with different melting points as taught by Wood et al. to the method of producing a solar cell module of Tsuzuki et al. in order in order to aid in the assembly of the semiconductor module with two different electrode materials that needs two different sold materials.

4. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to claim 6 above, and in further view of Nakahara et al (JP 2002/346788).

With respect to claim 7, modified Tsuzuki et al. discloses all the features of claim 6 above, but fails to disclose that the solder layer with higher melting point is substantially free of lead.

Nakahara et al. teach a lead-free, Sn-Ag based solder alloy that is an environmentally sound (paragraphs 0003 and 0004) alternative to Pb-based solder while providing high joint dependability (paragraph 0006). The specific composition of the alloy is given in paragraph 0008, which lists both Ag and P as constituents. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the solder of Nakahara et al. for fixing the connection tabs to the electrodes of the modified Tsuzuki et al. in order to render the latter environmentally sound while providing high joint dependability.

5. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to claim 5 above, and in further view of Okada et al. (US Patent 6,571,469).

As to claims 8 and 9, modified Tsuzuki et al. discloses all the features of claim 5 above and further discloses that the connection tabs of Tsuzuki et al. (metal member, 104) are connected by means of a solder to a common connection line (bus bar, 102) as described in Column 7, lines 3-10. However, modified Tsuzuki et al. fails to disclose: (1) through holes at the connection areas between the connection tabs and the surface

electrodes or the back surface electrodes or (2) that the connection tabs are provided with through holes at connection areas between the connection tabs and the common connection line.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (column 3, lines 45-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. at the connection areas between the connection tabs and the surface electrodes in modified Tsuzuki et al. above, in order to bond the surface of the connection tab to the surface of the surface electrode to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them. Similarly, it would also have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. at the connection areas between the connection tabs and the connection line in the method of producing the solar cell of modified Tsuzuki et al., in order to bond the surface of the connection tab to the surface of the connection line to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

As to claim 10, modified Tsuzuki et al. discloses all the features of claim 5 above and further discloses that the connection tabs of Tsuzuki et al. (metal member, 104) are connected by means of a solder to a common connection line (bus bar, 102) as described in Column 7, lines 3-10. However, modified Tsuzuki et al. fails to disclose that the common connection line is provided with through holes at connection areas between the common connection line and the connection tabs.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (Column 3, lines 45-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. to the method of producing the solar cell of modified Tsuzuki et al. in the common connection line in order to bond the surface of the connection tab to the surface of the connection line to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

6. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to claim 5 above, and in further view of Mizukami et al. (US Patent 6,369,315) and Okada et al.(US Patent 6,571,469).

With respect to claims 11 and 12, modified Tsuzuki et al. discloses all the features of claim 5 above, but fails to disclose a terminal box or output wires used to connect the solar cell elements to the terminals of that box.

Mizukami et al. disclose a power generation system specifically for use with an array of photovoltaic modules (Figure 1). Like the apparatus of Tsuzuki et al., Mizukami et al. connect their photovoltaic array via bus bars (bus bar, 13, Figure 1). The major advantage of the system of Mizukami et al. over that of Tsuzuki et al., described in Column 5, lines 24-28 of Mizukami et al., is that its bus bars contain extensions (13b) that are connected directly to "an output fetching line" (or a line that allows the power outputted by the cells to be used by the outside world) via a terminal box (17). As Mizukami et al. explain in column 2, lines 5-10, using said features with said type of terminal box allows the number of soldering spots in an output fetching wiring to be reduced. As shown in Figure 1 and explained in Column 5, lines 32-35, the output wires (bus bar extensions, 13b) connect the solar cell elements with the terminals (terminals, 18) of a terminal box (17) by means of solder (solder, 23). It would have been obvious to one of ordinary skill in the art at the time of the invention to add the bus bar extensions and the terminal box of Mizukami et al. to the modified device of Tsuzuki et al. in order to reduce the number of soldering spots in output fetching wiring. However, modified Tsuzuki et al. al. fails to teach that the output wires or the terminals of the box are provided with through holes at connection areas between the terminals and the output wires.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (Column 3, lines 45-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. while providing the through holes either the output wires or the terminals of modified Tsuzuki et al., in order to bond the surface of the wire to the surface of the terminals to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

7. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to claim 25 above, and in further view of Nakahara et al (JP 2002/346788).

With respect to claim 26, modified Tsuzuki et al. discloses all the features of claim 6 above, but fails to disclose that the solder layer with higher melting point is substantially free of lead.

Nakahara et al. teach a lead-free, Sn-Ag based solder alloy that is an environmentally sound (paragraphs 0003 and 0004) alternative to Pb-based solder while providing high joint dependability (paragraph 0006). The specific composition of

the alloy is given in paragraph 0008, which lists both Ag and P as constituents. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the solder of Nakahara et al. for fixing the connection tabs to the electrodes of the modified Tsuzuki et al. in order to render the latter environmentally sound while providing high joint dependability.

8. Claims 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to claim 25 above, and in further view of Okada et al. (US Patent 6,571,469).

As to claims 27-29, modified Tsuzuki et al. discloses all the features of claim 5 above and further discloses that the connection tabs of Tsuzuki et al. (metal member, 104) are connected by means of a solder to a common connection line (bus bar, 102) as described in Column 7, lines 3-10. However, modified Tsuzuki et al. fails to disclose: (1) through holes at the connection areas between the connection tabs and the surface electrodes or the back surface electrodes or (2) that the connection tabs are provided with through holes at connection areas between the connection tabs and the common connection line.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (Column 3, lines 45-48). It would have

been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. at the connection areas between the connection tabs and the surface electrodes in modified Tsuzuki et al. above, in order to bond the surface of the connection tab to the surface of the surface electrode to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them. Similarly, it would also have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. at the connection areas between the connection tabs and the connection line in the method of producing the solar cell of modified Tsuzuki et al., in order to bond the surface of the connection tab to the surface of the connection line to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

As to claim 28, modified Tsuzuki et al. discloses all the features of claim 5 above and further discloses that the connection tabs of Tsuzuki et al. (metal member, 104) are connected by means of a solder to a common connection line (bus bar, 102) as described in Column 7, lines 3-10. However, modified Tsuzuki et al. fails to disclose that the common connection line is provided with through holes at connection areas between the common connection line and the connection tabs.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely”

even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (Column 3, lines 45-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. to the method of producing the solar cell of modified Tsuzuki et al. in the common connection line in order to bond the surface of the connection tab to the surface of the connection line to each other more reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

9. Claims 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuzuki et al. (US Patent 6, 479,744) and Wood et al. (US Patent 6,150,717) as applied to Claim 25 above, and in further view of Mizukami et al. (US Patent 6,369,315) and Okada et al.(US Patent 6,571,469).

With respect to claims 30 and 31, modified Tsuzuki et al. discloses all the features of claim 25 above, but fails to disclose a terminal box or output wires used to connect the solar cell elements to the terminals of that box.

Mizukami et al. disclose a power generation system specifically for use with an array of photovoltaic modules (Figure 1). Like the apparatus of Tsuzuki et al., Mizukami et al. connect their photovoltaic array via bus bars (bus bar, 13, Figure 1). The major advantage of the system of Mizukami et al. over that of Tsuzuki et al., described in Column 5, lines 24-28 of Mizukami et al., is that its bus bars contain extensions (13b) that are connected directly to “an output fetching line” (or a line that allows the power

outputted by the cells to be used by the outside world) via a terminal box (17). As Mizukami et al. explain in Column 2, lines 5-10, using said features with said type of terminal box allows the number of soldering spots in an output fetching wiring to be reduced. As shown in Figure 1 and explained in Column 5, lines 32-35, the output wires (bus bar extensions, 13b) connect the solar cell elements with the terminals (terminals, 18) of a terminal box (17) by means of solder (solder, 23). It would have been obvious to one of ordinary skill in the art at the time of the invention to add the bus bar extensions and the terminal box of Mizukami et al. to the modified device of Tsuzuki et al. in order to reduce the number of soldering spots in output fetching wiring. However, modified Tsuzuki et al. al. fails to teach that the output wires or the terminals of the box are provided with through holes at connection areas between the terminals and the output wires.

Okada et al. disclose a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (Column 3, lines 45-48). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the soldering method along with the through holes of Okada et al. while providing the through holes either the output wires or the terminals of modified Tsuzuki et al., in order to bond the surface of the wire to the surface of the terminals to each other more

reliably (i.e., more securely even when the electrodes are subject to warpage) by allowing molten solder to flow more freely between them.

Response to Arguments

Claim Rejections under 35 USC 103

10. With respect to claim 5, 6, 8-10, 23, 25, and 27-29, the Applicant argues that Tsuzuki only teaches a connection by way of solder on a back surface of a solar cell (Tsuzuki, column 3, lines 14-15; column 16, lines 30-35); and Tsuzuki fails to teach or suggest a solder connection for use in a connection tab for connecting in the front surface of the solar cell.

The Examiner respectfully disagrees. Tsuzuki et al. provides a step (col.2; lines: 37-38) for connection tabs/metal member (104) for interconnecting the surface electrode on the light-receiving surface (front surface of the cell) and the back surface electrode on the non-light receiving surface of the solar cell elements as shown in Figures 5A and 5B (col.2; lines: 59-67 & col.3; lines: 1-2).

Woods teaches the deficiencies of Tsuzuki at al. by disclosing a method for mounting electrical interconnections with solder (i.e. melting the solder) to the electrodes of the semiconductor device (col.1; lines: 15-24) and further discloses that one of the solder alloys can be a high temperature alloy and the other solder alloy a low temperature alloy and that it aids in the assembly of the semiconductor module (col.9; lines: 6-22). Wood teaches that when an electrode is of a lower melting temperature and the solder is of a higher melt temperature, then the solder can be reflowed to form

bonded connections (col. 9; lines: 61-67). Wood further teaches that the solder temperature is chosen between the melt temperature of the electrode and solder melt temperature to allow for the solder to soften and not enter the liquid phase, such that it will have a structural rigidity (col. 9; lines: 61-67).

The Applicant further argues that neither Tsuzuki nor Wood teach or suggest that there is a need for two different electrode materials that need two different solder materials and consequently, the necessary suggestion or motivation is not disclosed in the cited references. The Applicant further argues that the electrodes of Tsuzuki or Wood are technically different from the Applicant's invention.

Woods teaches the deficiencies of Tsuzuki at al. by disclosing a method for mounting electrical interconnections with solder (i.e. melting the solder) to the electrodes of the semiconductor device (col.1; lines: 15-24) and further discloses that one of the solder alloys can be a high temperature alloy and the other solder alloy a low temperature alloy and that it aids in the assembly of the semiconductor module (col.9; lines: 6-22). Wood teaches that when an electrode is of a lower melting temperature and the solder is of a higher melt temperature, then the solder can be reflowed to form bonded connections (col. 9; lines: 61-67). Wood further teaches that the solder temperature is chosen between the melt temperature of the electrode and solder melt temperature to allow for the solder to soften and not enter the liquid phase, such that it will have a structural rigidity (col. 9; lines: 61-67).

The Applicant argues that Tsuzuki fails to teach or suggest a connection by using two connection tabs and therefore, a step for connecting a first and a second connection tab is absent from Tsuzuki.

The Examiner respectfully disagrees. Tsuzuki et al. discloses two tabs attached to the top and bottom of the cells which is referenced by 103 and 103' as depicted in Figure 5B.

The Applicant argues that the present invention is not obvious from Tsuzuki which teaches a photovoltaic module to transform light to electricity, in view of Wood, because Wood teaches a multichip module in a different field where a plurality of dice are mounted on a single supporting substrate.

The Examiner respectfully disagrees. Tsuzuki et al. discloses that the photovoltaic module has electricity collections means (i.e. the photovoltaic module generates electricity) (col. 1; lines: 65-67) and Wood teaches a solution to a pertinent problem such as providing a soldering electrode in order to transfer the generated electricity.

With regard to claims 7 and 26, the Applicant argues that Nakahara cannot remedy the defect of Tsuzuki and Wood and the cited references fail to teach or suggest each and every claim limitation.

The Examiner respectfully disagrees. Nakahara serves to remedy the defects of modified Tsuzuki by disclosing the use of Sn-Ag based solder alloy that is an

environmentally sound (paragraphs 0003 and 0004) alternative to Pb-based solder while providing high joint dependability (paragraph 0006).

In respect to claims 11-12 and 30-31, the Applicant argues that Tsuzuki, Wood, Mizukami et al. and Okada fail to teach or suggest each and every claim limitation.

The Examiner respectfully disagrees. Okada serves to remedy the defects of modified Tsuzuki by Okada disclosing a soldering method (Figure 26) for the manufacture of a modular board (Figure 1) with multiple electrodes. The method includes the use of through-holes (through holes, 103) in order to bond said electrodes more “securely” even “when the board is subject to warpage” (Column 1, lines 63-65 and Column 2, lines 1-10). The through-holes allow molten solder to flow freely between the two electrodes to create a more reliable contact (column 3, lines 45-48).

Mizukami et al. disclose a power generation system specifically for use with an array of photovoltaic modules (Figure 1). Like the apparatus of Tsuzuki et al., Mizukami et al. connect their photovoltaic array via bus bars (bus bar, 13, Figure 1). The major advantage of the system of Mizukami et al. over that of Tsuzuki et al., described in Column 5, lines 24-28 of Mizukami et al., is that its bus bars contain extensions (13b) that are connected directly to “an output fetching line” (or a line that allows the power outputted by the cells to be used by the outside world) via a terminal box (17). As Mizukami et al. explain in column 2, lines 5-10, using said features with said type of terminal box allows the number of soldering spots in an output fetching wiring to be reduced. As shown in Figure 1 and explained in Column 5, lines 32-35, the output wires

(bus bar extensions, 13b) connect the solar cell elements with the terminals (terminals, 18) of a terminal box (17) by means of solder (solder, 23).

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ASHA HALL whose telephone number is (571)272-9812. The examiner can normally be reached on Monday-Thursday 8:30-7:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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AJH
/A. H./
Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795